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Barriers to Non-HDL Cholesterol Goal Attainment by Providers

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Abstract

Purpose—Despite improvements in low-density lipoprotein cholesterol goal attainment, non-high-density lipoprotein cholesterol (non-HDL-C) goal attainment remains poor. This study assessed providers' knowledge of, attitude toward, and practice regarding non-HDL-C.

Methods—Based on a conceptual model, we designed a questionnaire which was administered to internal medicine, family practice, cardiology, and endocrinology providers attending continuous medical education conferences. Responses were compared to those of providers attending a clinical lipidology conference.

Results—Response rate was 33.3% (354/1,063). Among providers attending nonlipidology conferences, only 26% knew that non-HDL-C was a secondary treatment target, 34% knew non-HDL-C treatment goals, 56% could calculate non-HDL-C levels, and 66% knew that non-HDL-C levels could be calculated from a standard lipid panel. Compared with providers attending the lipidology conference, the other providers were less likely ($p = 0.01$) to have read the Adult Treatment Panel III (ATP III) guidelines (46% vs. 98%) or to use non-HDL-C (36% vs. 91%). No

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differences were found between primary care and specialty providers. Lack of familiarity with ATP III guidelines (34%) and of knowledge regarding non-HDL-C importance (21%) and calculation (22.7%) were the most common barriers identified.

Conclusions—Major gaps remain in providers' awareness regarding non-HDL-C definition, calculation, and goals. System-level interventions are needed across specialties to address these gaps.

Keywords

guideline adherence; non-HDL cholesterol; Adult Treatment Panel III guidelines; provider knowledge; treatment practice

INTRODUCTION

Multiple studies have shown that non-high-density lipoprotein cholesterol (non-HDL-C) is a better marker of cardiovascular risk than low-density lipoprotein cholesterol (LDL-C).¹⁻³ The Adult Treatment Panel III (ATP III) cholesterol guidelines recommend non-HDL-C as a secondary treatment target in patients with elevated triglycerides,⁴ but non-HDL-C goal attainment is poor.⁵

The aim of our study was to understand and assess gaps in providers' knowledge, attitude, and behavior towards non-HDL-C using a questionnaire, and to ascertain whether these gaps differ by practice specialty.

METHODS

We developed a conceptual model (Figure 1), adapted from the model of Cabana et al.⁶, to identify barriers to non-HDL-C goal attainment in 3 domains: knowledge, attitude, and behavior. A questionnaire (Appendix online) was then developed and administered to providers attending local and regional continuing medical education (CME) activities targeted to providers in internal medicine and family practice and the subspecialties of cardiology and endocrinology and in which clinical lipidology was not the main topic. We also administered the questionnaire to attendees at a major national CME conference in clinical lipidology. Providers were not remunerated for participation.

We calculated the proportions of providers who could define non-HDL-C, calculate non-HDL-C from a standard lipid panel, and identify non-HDL-C goals and who reported calculating non-HDL-C levels as recommended by the ATP III guidelines.⁴ Initially, internal medicine, family practice, cardiology, and endocrinology providers were compared as a group to providers attending the clinical lipidology conference (the referent group, as they would be expected to know most of the correct responses). We subsequently performed stratified analyses comparing primary care (internal medicine and family practice) providers versus specialty (cardiology and endocrinology) providers after excluding the referent group. Finally, we created separate logistic regression models to ascertain independent predictors associated with ability to calculate non-HDL-C levels and awareness of non-HDL-C goals. All analyses were conducted with SPSS version 17 (SPSS Inc, Chicago, IL).

RESULTS

We administered the survey at 5 CME conferences (2 internal medicine/family practice, 2 cardiology, and 1 clinical lipidology). The response rate was 33.3% (354/1063). Mean age of the cohort (Table 1) was 50 years. A higher proportion of providers reported practicing internal medicine or family practice. The providers were on average 18 years out of their medical training.

Almost all providers attending the clinical lipidology conference reported having read the ATP III guidelines or summary, compared with only one half of providers in the other category (Table 2). Providers attending the clinical lipidology conference performed significantly better on all questions testing knowledge and also reported higher use of non-HDL-C levels in patients with elevated triglycerides. Of the providers in the other category, three fourths were not aware of non-HDL-C as a secondary treatment target, one third were not aware that non-HDL-C levels could be calculated from a standard lipid panel, almost half were not able to calculate non-HDL-C levels on a hypothetical patient, only one third knew that the treatment goal for non-HDL-C was 30 mg/dl above the LDL-C treatment goal, and roughly one third reported calculating non-HDL-C levels in patients with elevated triglycerides.

Table 3 compares the responses of primary care providers (internal medicine and family practice) and specialty providers (cardiology and endocrinology), excluding those attending the clinical lipidology conference. The only difference between the two groups was that a higher proportion of primary care providers knew the definition of non-HDL-C compared with specialty providers.

The most commonly reported barriers to using non-HDL-C were lack of familiarity with the guidelines (34%), lack of knowledge regarding the importance of non-HDL-C (21%), and lack of knowledge of how to calculate non-HDL-C (23%). In logistic regression analyses (data not shown), only age had a small but significant inverse association with providers' ability to calculate non-HDL-C levels from a lipid panel.

DISCUSSION

After excluding "cholesterol experts," at least half of the providers responding to our questionnaire did not know the definition of non-HDL-C, 34% did not know that non-HDL-C levels can be calculated from a standard lipid panel, and half could not calculate non-HDL-C levels. In addition, only one third reported routinely calculating non-HDL-C levels in patients with elevated triglycerides, despite the guidelines' recommendation.⁴ These results likely underestimate the true prevalence of this lack of knowledge and implementation, because the least-informed providers would be less likely to complete the questionnaire.

An Institute of Medicine report suggested that, on average, it took 17 years for new knowledge to be incorporated into clinical practice.⁷ This gap between evidence and practice can be bridged only by positively influencing provider behavior.⁸ Our findings indicate that emphasis on evidence-based guideline development is only one aspect of the guideline

implementation process, which also requires greater efforts towards guideline dissemination. Studies in provider behavior have shown that passive diffusion of guidelines from publication in professional journals or distribution alone will likely not suffice.^{8–10} More active efforts such as academic detailing,¹¹ audit and feedback strategies,¹² and the use of decision support system¹³ are needed.

Our findings indicate that greater efforts are required for guideline dissemination and education. Almost half of the providers in our survey had not read the ATP III guidelines despite having a high proportion of patients with dyslipidemia, and only 56% could calculate non-HDL-C levels from a lipid panel. Directly reporting non-HDL-C levels on standard lipid panel results as suggested by some¹ might be useful to improve guideline implementation, especially if the report also provides a list of non-HDL-C goals. However, providers are unlikely to use non-HDL-C if they do not know its importance (self-reported by 21% of nonlipidology providers in our study), underscoring the need for greater educational efforts to improve implementation.

Limitations of our study include the response rate (33%) and possible overrepresentation of more motivated and/or better informed providers attending CME sessions, limiting generalizability. Real-world results with “average” providers would likely be worse.

Conclusion

Major gaps remain in providers’ knowledge and practice patterns regarding non-HDL-C. System-level interventions, targeted towards both primary care and specialty providers, are needed to improve guideline dissemination and adherence.

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APPENDIX

Clinical Practices for Cholesterol Management Questionnaire

We would like to know how you currently manage your patients' cholesterol levels and your views on the NCEP ATP III hyperlipidemia guidelines. We greatly appreciate your taking 5–10 minutes to complete this questionnaire.

Age: _____ **Gender:** ☐ M ☐ F

Please check one: ☐ Physician ☐ Nurse Practitioner ☐ Physician Assistant

☐ Other (Please specify) _____

Primary Specialty: ☐ Internal Medicine ☐ Family Practice ☐ Endocrinology ☐ Cardiology

☐ Other (please specify) _____

Number of years since completing residency or fellowship: _____

Practice area: ☐ Outpatient only ☐ Inpatient only ☐ Both inpatient and outpatient

Type of practice: ☐ Private ☐ Academic ☐ Private with an academic affiliation

Number of outpatients seen every day: _____

What percentage of your patients have dyslipidemia: _____

How often do you order advanced lipid testing on your patients [e.g., Apolipoprotein B measurements, Berkley, Vertical Auto Profile (VAP test), LDL particle number measurement (NMR)]?

☐ not at all ☐ rarely ☐ occasionally ☐ frequently

1. To what extent are you aware of the Adult Treatment Panel (ATP) III guidelines on treatment of hyperlipidemia?
 - ☐ a. I am not aware of the ATP III guidelines.
 - ☐ b. I am aware of its existence, but not aware of its contents
 - ☐ c. I have read the executive summary.
 - ☐ d. I have read the full report.
2. What is the current secondary treatment target per the ATP III cholesterol treatment guidelines?
 - ☐ a. LDL cholesterol (LDL-C)
 - ☐ b. Total cholesterol levels
 - ☐ c. High-density lipoprotein cholesterol (HDL-C)
 - ☐ d. Non-high-density lipoprotein cholesterol (non-HDL-C)
 - ☐ e. Triglycerides.
3. Non-HDL cholesterol includes:
 - ☐ (a) LDL cholesterol plus total cholesterol levels
 - ☐ (b) LDL cholesterol levels minus HDL cholesterol levels
 - ☐ (c) Total cholesterol levels plus VLDL cholesterol levels
 - ☐ (d) Total cholesterol minus HDL cholesterol levels

Instructions: For the following statements, please answer “True” or “False” by circling the appropriate number.

	True	False
4. Optimal treatment goal of LDL cholesterol in patients at high risk for cardiovascular disease is less than 100 mg/dl.	1	2
5. HDL-C level less than 40 mg/dl is a risk factor for coronary heart disease.	1	2
6. Statins lower LDL-C levels.	1	2
7. Optional goal for LDL-C in patients with acute coronary syndrome is less than 70 mg/dl.	1	2
8. High dose statin therapy can decrease triglycerides.	1	2

	True	False
9. Non-HDL-C levels cannot be calculated from a standard lipid panel.	1	2
10. I routinely measure lipoprotein(a) [Lp(a)] on my patients with coronary artery disease.	1	2
11. I routinely calculate non HDL-C levels on my patients with elevated triglycerides.	1	2
12. Fibrates, fish oil and niacin therapy lower triglyceride levels.	1	2
13. Statins lower non-HDL-C.	1	2
14. Non-HDL-C treatment goal is 60 mg/dl higher than the LDL-C treatment goal for any given patient.	1	2
15. High dose statin therapy increases risk of liver function test abnormalities more compared to lower doses.	1	2

Instructions: Please indicate how strongly you agree with each of the following statements by circling the appropriate number on the response scale.

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
16. Achieving optimal levels of non-HDL-C is at least as important as achieving optimum levels of LDL-C.	1	2	3	4	5
17. Triglycerides are a risk factor for coronary artery disease.	1	2	3	4	5
18. I would pay more attention to the non-HDL-C if the levels were listed on the standard lipid panel.	1	2	3	4	5

19 When do you calculate non-HDL-C levels on your patients?

- ☐ (a) routinely on all patients
- ☐ (b) only in patients with triglycerides ≥ 200 mg/dl
- ☐ (c) I do not calculate non-HDL-C levels on my patients

20 In a patient with history of acute coronary syndrome who is on statin therapy with the following lipid panel, what is the most important treatment target?

Total cholesterol = 190 mg/dl, LDL-C = 67 mg/dl, HDL-C = 42 mg/dl, triglycerides = 270 mg/dl

- ☐ (a) LDL-C less than 50 mg/dl
- ☐ (b) HDL-C greater than 60 mg/dl
- ☐ (c) Non-HDL-C less than 100 mg/dl
- ☐ (d) Lp(a) less than 75 nmol/L

☐ (e) Apo B concentration of less than 60 mg/dl

21 In a patient with the following lipid panel, what is the non-HDL-C level?

Total cholesterol = 210 mg/dl, LDL-C = 90 mg/dl, HDL-C = 43 mg/dl,
triglycerides = 160 mg/dl

☐ (a) 120 mg/dl

☐ (b) 70 mg/dl

☐ (c) 47 mg/dl

☐ (d) 167 mg/dl

☐ (e) 133 mg/dl

22 According to ATP III treatment guidelines, what is the recommended non-HDL-C goal?

☐ (a) 10 mg/dl above the LDL-C goal

☐ (b) 30 mg/dl above the LDL-C goal

☐ (c) 60 mg/dl above the LDL-C goal

☐ (d) 30 mg/dl above the triglyceride goal

☐ (e) 30 mg/dl above the HDL-C goal

23 If you do not currently calculate non-HDL-C levels on your patients, why not? Below we have listed many possible reasons. Please check all that apply.

☐ (a) I am not very familiar with the ATP III cholesterol management guidelines.

☐ (b) I do not agree with the current ATP III guidelines.

☐ (c) I am not aware of the data that non-HDL-C levels are important in cardiovascular risk reduction.

☐ (d) I am aware of the data but do not believe that non-HDL-C levels are important in my patients.

☐ (e) I believe that after achieving LDL-C goals, non-HDL-C levels are not important in improving cardiovascular outcomes in my patients.

☐ (f) I believe that I do not need to calculate non-HDL-C levels since I get the same information from specialized lipid testing (i.e., apo B measurement, Berkeley, NMR).

☐ (g) I do not know how to calculate non-HDL-C from a standard lipid panel.

☐ (h) I know how to calculate non-HDL-C levels, but do not have time to calculate non-HDL-C levels on my patients.

☐ (i) I do not know what drugs lower non-HDL-C levels.

☐ (j) My patients will not be compliant with medications used to lower non-HDL-C levels.

☐ (k) The medication cost associated with non-HDL-C lowering in my patients will be prohibitive.

☐ (l) Other reasons: _____

Any comments or concerns about the questionnaire? Please comment on the reverse side.

Thank you for participating in our study!

Figure 1.

Conceptual model of why a provider may not be able to follow guidelines regarding non-HDL-C (based on conceptual model by Cabana et al.⁶). ATP III, Adult Treatment Panel III; non-HDL-C, non-high-density lipoprotein cholesterol; TGs, triglycerides; NP, nurse practitioner; PA, physician assistant.

Lack of self efficacy = provider's belief that he/she cannot perform guideline recommendations for non-HDL-C, lack of outcome expectancy = provider's belief that non-HDL-C goal attainment will not improve patient outcomes.

Table 1

Characteristics of the overall study population

Characteristic	Participants (n=354)*
Male, No. (%)	176 (52.1)
Age, mean (SD), y	50 (12)
Time since completion of residency or fellowship training, mean (SD), y	18 (12)
Primary practice specialty, No. (%)	
Internal medicine	80 (23)
Family practice	118 (33)
Cardiology	78 (22)
Endocrinology	12 (3)
Other	48 (14)
Missing	18 (5)
Nonphysician provider (nurse practitioner or physician assistant)	92 (26)
Practice area, No. (%)	
Outpatient only	166 (47)
Inpatient only	13 (4)
Both inpatient and outpatient	148 (42)
Missing	27 (8)
Type of practice, No. (%)	
Private	182 (51)
Academic	66 (19)
Private with academic affiliation	59 (17)
Missing	47 (13)
Outpatients seen daily, mean (SD)	19 (11)
Mean percentage of patients in a provider's panel with diagnosis of dyslipidemia, mean (SD)	59 (26)
Providers using specialized lipid testing* occasionally or frequently, No. (%)	121 (34)

SD, standard deviation

* Specialized lipid testing includes any of the following: apolipoprotein B measurement, Berkeley test, Vertical Auto Profile (VAP test), LDL particle number measurement using nuclear magnetic resonance.

Table 2

Responses of providers to questions in the knowledge domain of the conceptual model

Question *	Family practice, internal medicine, cardiology, and endocrinology providers, % (No.) (n=256)	Attendees at a major lipidology conference, % (No.) (n=90)	P
Provider has read either the summary or the full ATP III guideline report (item 1)	45.7 (117)	97.8 (88)	<0.001
Provider aware that non-HDL-C is a secondary treatment target (item 2)	26 (66)	90 (81)	<0.001
Provider aware that non-HDL-C levels can be calculated from a standard lipid panel (item 9)	66 (169)	88(79)	0.001
Provider knows the definition of non-HDL-C [†] (item 3)	67 (172)	90 (100)	<0.001
Provider calculates non-HDL-C in patients with elevated triglycerides (item 19)	36 (91)	91 (82)	<0.001
Provider able to identify non-HDL-C as a secondary treatment target in a patient with elevated triglycerides when LDL-C is at goal (item 20)	46 (118)	87 (78)	<0.001
Provider able to calculate non-HDL-C levels when provided with a standard lipid panel (item 21)	56 (143)	96 (86)	<0.001
Provider aware that statins lower non-HDL-C levels (item 13)	79 (202)	90 (81)	0.02
Provider aware of the non-HDL-C treatment goal as 30 mg/dl above the LDL-C goal (item 22)	34 (88)	92 (83)	<0.001

ATP III, Adult Treatment Panel III; non-HDL-C, non-high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol.

* See questionnaire in Appendix, online.

[†] non-HDL-C, total cholesterol minus HDL-C

Table 3

Responses of providers to questions in the knowledge domain of the conceptual model across practice specialties

Question *	Practice specialty		P
	Family practice and internal medicine providers, % (No.) (n=163) [†]	Cardiology and endocrinology providers, % (No.) (n=49) [‡]	
Provider has read either the summary or the full ATP III guideline report (item 1)	53.4 (87)	49 (24)	0.59
Provider aware that non-HDL-C is a secondary treatment target (item 2)	31 (50)	25 (12)	0.40
Provider aware that non-HDL-C levels can be calculated from a standard lipid panel (item 9)	70 (113)	65 (32)	0.60
Provider knows the definition of non-HDL-C [‡] (item 3)	72 (118)	55 (27)	0.02
Provider calculates non-HDL-C in patients with elevated triglycerides (item 19)	34 (55)	39 (19)	0.52
Provider able to identify non-HDL-C as a secondary treatment target in a patient with elevated triglycerides when LDL-C is at goal (item 20)	50 (81)	41 (20)	0.28
Provider able to calculate non-HDL-C levels when provided with a standard lipid panel (item 21)	61 (99)	49 (24)	0.14
Provider aware that statins lower non-HDL-C levels (item 13)	84 (137)	76 (37)	0.17
Provider aware of the non-HDL-C treatment goal as 30 mg/dl above the LDL-C goal (item 22)	35 (57)	39 (19)	0.63

* See questionnaire in Appendix, online.

[†] Numbers are lower than in Table 1 because providers attending the clinical lipidology conference were excluded from these analyses.

[‡] non-HDL-C, total cholesterol minus HDL-C